



AIR QUALITY ASSESSMENT

FOR

CALUM MCGOWAN

AT

35 LIVERPOOL ROAD, MANCHESTER , M3 4NQ

AQ18099

10/06/2021

Prepared For

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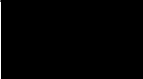
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QUALITY ASSURANCE

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Project Number	AQ18099		

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	4
1.0 INTRODUCTION	5
1.1 Background	5
1.2 Site Location and Context	5
1.3 Limitations	5
2.0 LEGISLATION, GUIDANCE AND POLICY	6
2.1 UK Legislation and Guidance	6
2.2 Local Planning Policy	7
3.0 METHODOLOGY	9
3.1 Construction Phase Assessment	9
3.2 Operational Phase Assessment	9
4.0 BASELINE	10
4.1 Local Air Quality Management	10
4.2 Air Quality Monitoring	10
4.3 Background Pollutant Concentrations	10
5.0 ASSESSMENT	12
5.1 Operational Phase Assessment	12
6.0 RECOMMENDATIONS	14
6.1 Construction Phase Mitigation	14
6.2 Operational Phase	14
7.0 CONCLUSION	15
8.0 ABBREVIATIONS	16
APPENDIX A - FIGURES	17
APPENDIX B – ASSESSMENT INPUTS	25
APPENDIX C – APPENDIX D – ASSESSOR CURRICULUM VITAE	35

EXECUTIVE SUMMARY

Ensaf Consultants were commissioned by Calum McGowan to undertake an Air Quality Assessment in support of a proposed residential development at 35 Liverpool Road, Manchester.

The proposals include the refurbishment of the derelict property, to provide a single residential dwelling including the demolition of a single storey rear extension and construction of a replacement three-storey extension.

The application site is located within an area identified by the Greater Manchester Combined Authority as experiencing elevated pollutant concentrations. Subsequently, the Proposed Development has potential to introduce future users to poor air quality as well as, to cause impacts during the construction and operational phases. An Air Quality Assessment is therefore required to determine the baseline conditions at the site, assess site suitability for the proposed end-use and consider effects as a result of the development.

Given the minimal construction activities fugitive dust release related to the proposed development are deemed not significant. A dust risk assessment has therefore not been produced as part of the assessment. It is assumed that the contractor will follow industry standard dust control measures.

Dispersion modelling was undertaken in order to predict annual mean pollutant concentrations across the application site. Results were subsequently verified using local monitoring results provided by Manchester City Council.

The dispersion modelling results indicated that annual mean pollutant concentrations across the application site were **below the relevant air quality objectives** at proposed sensitive locations. The site is therefore considered suitable for proposed end use without the implementation of protective mitigation techniques.

There is no off-street parking provision as part of the proposed development, As such the level of anticipated traffic generation from the site is predicted to be **not significant** in accordance with relevant screening criteria.

Based on the assessment results the site is considered suitable for the proposed end use and complies with the Manchester City Council Local Plan and National Planning Policy Framework.

1.0 INTRODUCTION

1.1 Background

Ensafe Consultants has been commissioned by Calum McGowan, hereafter referred to as “the Client” to undertake an Air Quality Assessment in support of the refurbishment of the derelict property, to provide a single residential dwelling, herein after referred to as the “Proposed Development”.

1.2 Site Location and Context

The application site is located at 35 Liverpool Road, Manchester at approximate National Grid Reference (NGR) 383330, 397720. Reference should be made to Figure 1 within Appendix A for a location plan.

The application site is located within the Greater Manchester Air Quality Management Area (AQMA) which has been declared due to exceedances of the annual mean Air Quality Objective (AQO) for Nitrogen Dioxide (NO₂). Subsequently, the Proposed Development has the potential to introduce future residential occupants into an area of elevated NO₂ and Particulate Matter (PM) concentrations, as well as to cause impacts at sensitive receptor locations during the construction and operational phases.

An Air Quality Assessment has therefore been produced to quantify annual mean NO₂ and PM concentrations across the site to consider suitability for the proposed end-use, and to assess potential impacts as a result of the development. The assessment will be undertaken in accordance with the requirements of the National Planning Policy Framework (NPPF) and the Environmental Protection UK and Institute of Air Quality Management guidance.

1.3 Limitations

This report has been produced in accordance with Ensaf Consultants standard terms of engagement. Ensaf Consultants has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from Ensaf Consultants; a charge may be levied against such approval.

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2.0 LEGISLATION, GUIDANCE AND POLICY

The following legislation, guidance and policy will be considered and adhered to during the preparation of the Air Quality Assessment:

- European Union (EU) Directive 2008/50/EC;
- The National Planning Policy Framework (NPPF), updated on 19th February 2019);
- The National Planning Practice Guidance (NPPG), relevant chapters produced on 1st November 2019;
- Section 82 of the Environment Act (1995) (Part IV);
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007).
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Department for Environment, Food and Rural Affairs, 2007¹
- The Air Quality Standards (Amendment) Regulations (2016);
- Local Air Quality Management Technical Guidance 2016 LAQM.TG(16), DEFRA, 2018²;
- Guidance on the Assessment of Dust from Demolition and Construction, Institute of Air Quality Management (IAQM), v1.1, June 2016³;
- Land-Use Planning and Development Control: Planning for Air Quality, Environmental Protection UK and IAQM, January 2017⁴.

2.1 UK Legislation and Guidance

The Air Quality Standards (Amendment) Regulations (2016) came into force on 31st December 2016. These Regulations amend the Air Quality Standards Regulations 2010 and transpose the EU Directive 2008/50/EC into UK law. AQLVs were published in these regulations for 7 pollutants, as well as Target Values for an additional 6 pollutants.

Part IV of the Environment Act (1995) requires UK government to produce a national Air Quality Strategy (AQS) which contains standards, objectives and measures for improving ambient air quality. The most recent AQS was produced by DEFRA and published in July 2007¹. The AQS sets out Air Quality Objectives (AQOs) that are maximum ambient pollutant concentrations that are not to be exceeded either without exception or with a permitted number of exceedances over a specified timescale. These are generally in line with the AQLVs, although the requirements for compliance vary slightly.

Table 1 presents the AQOs for pollutants considered within this assessment.

Table 1: Air Quality Objectives

Pollutant	Air Quality Objectives	
	Concentration ($\mu\text{g}/\text{m}^3$)	Averaging Periods
NO ₂	40	Annual mean
	200	1-hour mean; not to be exceeded more than 18 times a year
PM ₁₀	40	Annual mean
	50	24-hour mean; not to be exceeded more than 35 times a year
PM _{2.5}	25	Annual Mean

Table 2 summarises the advice provided in DEFRA guidance LAQM.TG(16)2 on where the AQOs for pollutants considered within this report apply.

1 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DEFRA, 2007
2 Local Air Quality Management Technical Guidance 2016 LAQM.TG(16), DEFRA, February 2018.
3 Guidance on the Assessment of Dust from Demolition and Construction, Institute of Air Quality Management, 2016.
4 Land-Use Planning and Development Control: Planning for Air Quality, EPUK and IAQM, January 2017.

Table 2: Examples of Where the Air Quality Objectives Apply

Averaging Periods	Objectives Should Apply At	Objectives Should Not Apply At
Annual mean	All locations where members of the public might be regularly exposed Building façades of residential properties, schools, hospitals, care homes etc.	Building façades of offices or other places of work where members of the public do not have regular access Hotels, unless people live there as their permanent residence Gardens of residential properties Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24-hour mean	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
1-hour mean	All locations where the annual mean and 24-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets) Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer	Kerbside sites where the public would not be expected to have regular access

The results of the dispersion modelling assessment will also be compared against the relevant AQOs detailed in Table 1 to determine significance.

2.2 Local Planning Policy

2.2.1 Manchester's Local Development Framework Core Strategy

The Manchester Local Development Framework (LDF) Core Strategy⁵ was formally adopted in 2012 and provides a framework for development within the city. The LDF comprises a number of documents which set out Manchester City Council's (MCC's) spatial policy framework for delivering a number of policies contained within the Core Strategy which have been saved in accordance with the Planning and Compulsory Purchase Act (2004) and therefore provide the basis for the determination of planning applications prior to the finalisation of the local development framework.

A review of the Core Strategy indicated the following policy in relation to air quality that relevant to this assessment:

- **Policy EN16 - Air Quality**

"The Council will seek to improve the air quality within Manchester, and particularly within Air Quality Management Areas, located along Manchester's principal traffic routes and at Manchester Airport. Developers will be expected to take measures to minimise and mitigate the local impact of emissions from

traffic generated by the development, as well as emissions created by the use of the development itself, including from Combined Heat and Power and biomass plant.

When assessing the appropriateness of locations for new development the Council will consider the impacts on air quality, alongside other plan objectives. This includes cumulative impacts, particularly in Air Quality Management Areas."

- **Policy DM1 - Development Management**

"All development should have regard to the following specific issues for which more detailed guidance may be given within a supplementary planning document:

Effects on amenity, including privacy, light, noise, vibration, air quality, odours, litter, vermin, birds, road safety and traffic generation. This could also include proposals which would be sensitive to existing environmental conditions, such as noise."

Reference has been made to these policies during the undertaking of this Air Quality Assessment by assessing the impacts of road vehicle exhaust emissions on future site users and on nearby existing sensitive locations.

2.2.2 Greater Manchester Air Quality Action Plan

The Greater Manchester Air Quality Action Plan (AQAP)⁶ has involved a review of the strategies, policies and plans which tackle or are in some way related to air quality, to develop a clear, robust and meaningful set of actions which will deliver real changes in terms of air quality, whilst supporting the sustainable economic growth of the region.

The primary objectives of the AQAP are to improve air quality across Greater Manchester and to embed low-emission behaviours into the culture of our organisations and lifestyles by 2025, whilst supporting the UK Government in meeting all EU thresholds for key air pollutants. The Plan identifies 'Key Priority Areas' which are generally locations near to major roads and heavily trafficked areas in Manchester city centre, and other major urban centres across the other nine districts.

The AQAP comprises a single document including actions that will be ratified by Transport for Greater Manchester (TfGM) and district authorities to tackle air quality in Key Priority Areas, whilst supporting the sustainable economic growth of the region. This plan will allow councils to carry out their statutory duties under Part IV of the Environment Act 1995, as its implementation will help mandatory EU limit values to be met. Consideration to the action plan has been made throughout the preparation assessment. Reference has been made to the AQAP during the undertaking of this Air Quality Assessment.

Reference has been made to this policy during the undertaking of this Air Quality Assessment by assessing pollutant concentrations across the development site.

3.0 METHODOLOGY

3.1 Construction Phase Assessment

Given the limited processes involved with refurbishment and construction of the three storey extension, it is not considered that significant fugitive dust impacts would arise as a result of construction phase activities. Subsequently, the construction phase dust risk assessment has been screened out and has not been considered further in the preparation of the assessment. It is recommended that the contractor adheres to industry standard best practice dust management techniques during all demolition and construction works.

3.2 Operational Phase Assessment

3.2.1 Future Exposure

The Proposed Development is located within the Greater Manchester AQMA. As such, the proposals have the potential to introduce new receptors into an area of existing poor air quality, as well as to cause impacts upon existing pollution levels at nearby sensitive receptors within the AQMA..

Detailed dispersion modelling was therefore undertaken to quantify NO₂ and PM pollutant exposure across the site and determine suitability for the proposed use. The following modelling scenarios were utilised during the assessment:

- 2019 as baseline year for verification against latest ratified data;
- Opening year do-something (DS) (predicted traffic flows in 2023 should the proposals be completed).

As a result of the COVID-19 pandemic, travel restrictions have had an impact on modelling input parameters such as traffic data and local authority monitoring data. It is therefore recommended by the IAQM7 that data from 2020 will be used with caution and may not be useable. The 2019 baseline therefore provides the latest and reliable baseline information which can be relied upon with confidence.

The results of the dispersion modelling assessment will also be compared against the relevant AQOs detailed in Table 1 to determine significance. Full details of data used for the modelling assessment are presented in Appendix B of this report.

3.2.2 Road Vehicle Exhaust Emissions Impact Assessment

The anticipated trip generation associated is understood to be low given the lack of off-street parking. This information will be compared against the assessment criteria detailed with the EPUK and IAQM guidance⁴ to confirm the requirement for detailed assessment work. The EPUK and IAQM document states the following criteria to help establish when an air quality assessment is likely to be considered necessary:

- Proposals that will cause a change in Light Duty Vehicle (LDV) flows of more than 100 AADT within or adjacent to an AQMA;
- Proposals that will cause a change in Heavy Duty Vehicle (HDV) flows of more than 25 AADT within or adjacent to an AQMA;

Should the above criteria not be met, the EPUK and IAQM document considers air quality impacts associated with the scheme to be not significant and no further assessment is required. Conversely, should the criterion be exceeded it may be deemed necessary that further assessment is required.

⁷ <https://iaqm.co.uk/covid-19/>

4.0 BASELINE

Existing air quality conditions in the vicinity of the application site were identified in order to provide a baseline for assessment. These are detailed in the following sections.

4.1 Local Air Quality Management

As required by the Environment Act (1995), Greater Manchester Combined Authority (GMCA), has undertaken Review and Assessment of air quality within their area of administration. This process has indicated that annual mean concentrations of NO₂ are above the AQO within their administration. As such, one AQMA has been declared, described as:

- *AQMA Greater Manchester - An area covering the 10 districts of Greater Manchester, including arterial routes, district centres and airport.*

The application site is located within the AQMA, and has potential to introduce future site users into an area of elevated annual mean NO₂ concentrations. This has been considered within this report

GMCA has concluded that concentrations of all other pollutants considered within the AQS are currently below the relevant AQOs and as such no further AQMAs have been designated.

4.2 Air Quality Monitoring

Monitoring of pollutant concentrations is undertaken by MCC and Salford City Council (SCC) using continuous and passive methods throughout their areas of administration. A review of GMCA's most recent Air Quality Monitoring Data⁸ indicated that there are five diffusion tubes located within the vicinity of the application site, presented in Table 3.

Table 3: Diffusion Tube Monitoring Results

ID	Site Name	Type	NGR (m)		Dist' to Site (m)	Annual Mean Concentration (µg/m ³)		
			X	Y		2017	2018	2019
MAN77	Hewitt Street	Urban Background	383602	397488	360	38.81	40.99	43.66
MAN97	Chester Road	Urban Traffic	382886	397215	669	-	-	32.29
SA81	Regent Road	Roadside	382571	397718	754	-	-	46.4
SA60	Regent Road	Roadside	382445	397724	880	40.7	40.2	36.7
SA59	West Crown Ave	Urban Traffic	381822	397895	1,514	36.7	33.3	32.4

As indicated in Table 3, there were exceedances of annual mean AQO for NO₂ at three diffusion tube locations (MAN77, SA81 and SA60). Exceedances are likely due to their kerbside and roadside locations within or adjacent to AQMAs. Reference should be made to Figure 2 within Appendix A for a graphical representation of the monitoring locations.

4.3 Background Pollutant Concentrations

The total concentration of a pollutant is comprised of explicit local emission sources (such as roads and industrial sources) and the background component. The background component consists of indeterminate sources which are transported into an area from further away by meteorological conditions. Background pollutant concentrations are therefore the ambient level of pollution that is not affected by local sources of pollution.

In reality, it is not usually practical to obtain a true representation of background levels in urban areas due to corruption by local sources; background levels used in assessments may contain a mixture of both sources.

Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by DEFRA for the entire of the UK to assist LAs in their Review and Assessment of air quality. The Proposed Development site is located across grid square:

- NGR: 383500, 397500

Data for this location was downloaded from the DEFRA website⁹. For the purpose of this assessment, background concentrations are summarised in Table 4 for the verification year (2019) and the predicted development opening year (2023).

Table 4: Predicted Background Pollutant Concentrations

Pollutant	Predicted Background Concentration ($\mu\text{g}/\text{m}^3$)	
	2019	2023
NO _x	39.95	32.65
NO ₂	26.07	22.08
PM ₁₀	13.47	12.80
PM _{2.5}	8.69	8.22

As indicated in Table 4, background pollutant concentrations of NO₂ and PM are below the relevant AQOs detailed in Table 1. It should be noted that 2019 background concentrations (Table 4) have been used for future modelled scenarios to maintain conservative approach with 2023 data only presented for completeness.

5.0 ASSESSMENT

5.1 Operational Phase Assessment

The assessment was undertaken in accordance with the methodology detailed in Section 3.2, detailed modelling input parameters are provided in Appendix B.

5.1.1 Future Exposure

Annual mean NO₂ and PM concentrations were predicted across the Proposed Development for the 2023 DS scenario at a height of 1.5m to represent exposure across the ground floor level, as shown in Figures 7 and 9 within Appendix A.

Background NO₂ and PM₁₀ levels are likely to be lower at elevated heights due to increased distance from emission sources, such as roads. Therefore, predicted concentrations at heights above ground floor level are considered acceptable in regards to future exposure and have not been assessed further.

Nitrogen Dioxide (NO₂)

Predicted annual mean NO₂ concentrations across the Proposed Development site during the DS scenario are summarised in Table 5.

Table 5: Modelling Results - Annual Mean NO₂ at Proposed Sensitive Use

Floor Level	Predicted 2023 Annual Mean NO ₂ Concentration (µg/m ³)
Ground (1.5m)	31.10 – 32.10

The predicted concentrations shown in Table 5 indicate that there were no exceedances of the AQO at sensitive locations across ground floor areas of the proposed development. As such, it is considered that annual mean NO₂ levels at the Proposed Development site should not be viewed as a constraint to development.

Predictions of 1-hour NO₂ concentrations were not produced as part of the dispersion modelling assessment. LAQM.(TG16)² states if annual mean NO₂ concentrations are below 60µg/m³ then it is unlikely that the 1-hour AQO will be exceeded. As such, based on the results in Table 5, it is not predicted that on-site concentrations will exceed the 1-hour mean AQO for NO₂.

Based on the results of the dispersion modelling assessment, the site is considered to be suitable for residential use without the implementation of mitigation techniques to protect future site users from elevated NO₂ concentrations.

Particulate Matter (PM₁₀ & PM_{2.5})

Predicted annual mean PM concentrations across the Proposed Development site during the DS scenario are summarised in Table 6.

Table 6: Modelling Results - Annual Mean PM at Proposed Sensitive Use

Floor Level	Predicted 2023 Annual Mean Concentration (µg/m ³)	
	PM ₁₀	PM _{2.5}
Ground (1.5m)	14.37 – 14.52	9.21 – 9.30

The predicted concentrations shown in Table 6 indicate that there were no exceedances of the annual mean AQOs for PM₁₀ or PM_{2.5} throughout the modelling area. As such, it is considered that annual mean PM levels at the Proposed Development site should not be viewed as a constraint to development.

Based on the results of the dispersion modelling assessment, the site is considered to be suitable for proposed end use without the implementation of mitigation techniques to protect future site users from elevated PM concentrations.

5.1.2 Operational Phase Impacts

Any additional vehicle movements associated with the Proposed Development will generate exhaust emissions, such as NO₂, PM₁₀ and PM_{2.5} on the local and regional road networks.

The Proposed Development does not provide off-street parking provision and is sited with a sustainable location with numerous public transport and walking routes.

It is anticipated that the operational phase of the site will not result in a change of AADT flows of more than 100, produce over 25 HDV movements per day.

Subsequently, potential air quality impacts associated with operational phase road vehicle exhaust emissions are predicted to be **not significant** in accordance the EPUK and IAQM⁴ screening criteria shown in Section 3.2.2.

Furthermore, It is understood that the Proposed Development will provide a domestic gas-fired boiler. The boiler should meet a minimum standard of <40mgNO_x/kWh.

6.0 RECOMMENDATIONS

6.1 Construction Phase

As mentioned previously, external demolition/construction activities are minimal and will be short term. Following the IAQM guidance³ it is recommended that both the demolition and construction contractor applies industry standard dust control measures during external activities. This will ensure that associated dust impacts are mitigated.

6.2 Operational Phase

As specified in Section 5.10 of the IAQM guidance⁴ it is recommended that all new developments adhere to minimum emission standards for gas-fired boilers. In accordance with the guidance all proposed gas fired boilers should emit less than 40 mg/kWh NO_x.

7.0 CONCLUSION

Ensafe Consultants were commissioned by the Client to undertake an Air Quality Assessment in support of a proposed residential development at 35 Liverpool Road, Manchester.

Dispersion modelling was undertaken to quantify annual mean NO₂ and PM₁₀ concentrations across the application to assess suitability for proposed use. Modelling results were subsequently verified using MCC and SCC local monitoring data.

The dispersion modelling results indicated that annual mean NO₂, PM₁₀ and PM_{2.5} concentrations across the application site were **below the relevant AQOs** at the proposed sensitive use. The site is therefore considered suitable for the proposed end-use without the implementation of protective mitigation techniques to protect future amenity.

An assessment was undertaken using the EPUK and IAQM screening criteria to determine the potential for vehicle trips generated by the Proposed Development to affect local air quality. It is anticipated that the Proposed Development will not generate significant AADT flows on the local road network. Anticipated development traffic flows are deemed **below** the relevant EPUK and IAQM assessment thresholds and operational impacts could be screened out as **not significant**.

Based on the assessment results the site is considered suitable for the proposed end use and complies with the MCC Local Plan and NPPF.

8.0 ABBREVIATIONS

AADT	Annual Average Daily Traffic
ADM	Atmospheric Dispersion Modelling
AQLV	Air Quality Limit Value
AQMA	Air Quality Management Area
AQO	Air Quality Objectives
AQS	Air Quality Strategy
CERC	Cambridge Environmental Research Consultants
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DS	Do Something
DMP	Dust Management Plan
EPUK	Environmental Protection UK
EU	European Union
GMCA	Greater Manchester Combined Authority
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LA	Local Authority
LDV	Light Duty Vehicle
MCC	Manchester City Council
NGR	National Grid Reference
NO ₂	Nitrogen dioxide
NO _x	Oxides of nitrogen
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
PM _{2.5}	Particulate matter with an aerodynamic diameter of less than 2.5µm
PM ₁₀	Particulate matter with an aerodynamic diameter of less than 10µm
SCC	Salford City Council
TEMPRO	Trip End Model Presentation Program
z ₀	Roughness Length

END OF REPORT

APPENDIX A - FIGURES



Legend

-  Site Boundary
-  Air Quality Management Area

Title

Figure 1
Site Location

Project

35 Liverpool Road, Manchester

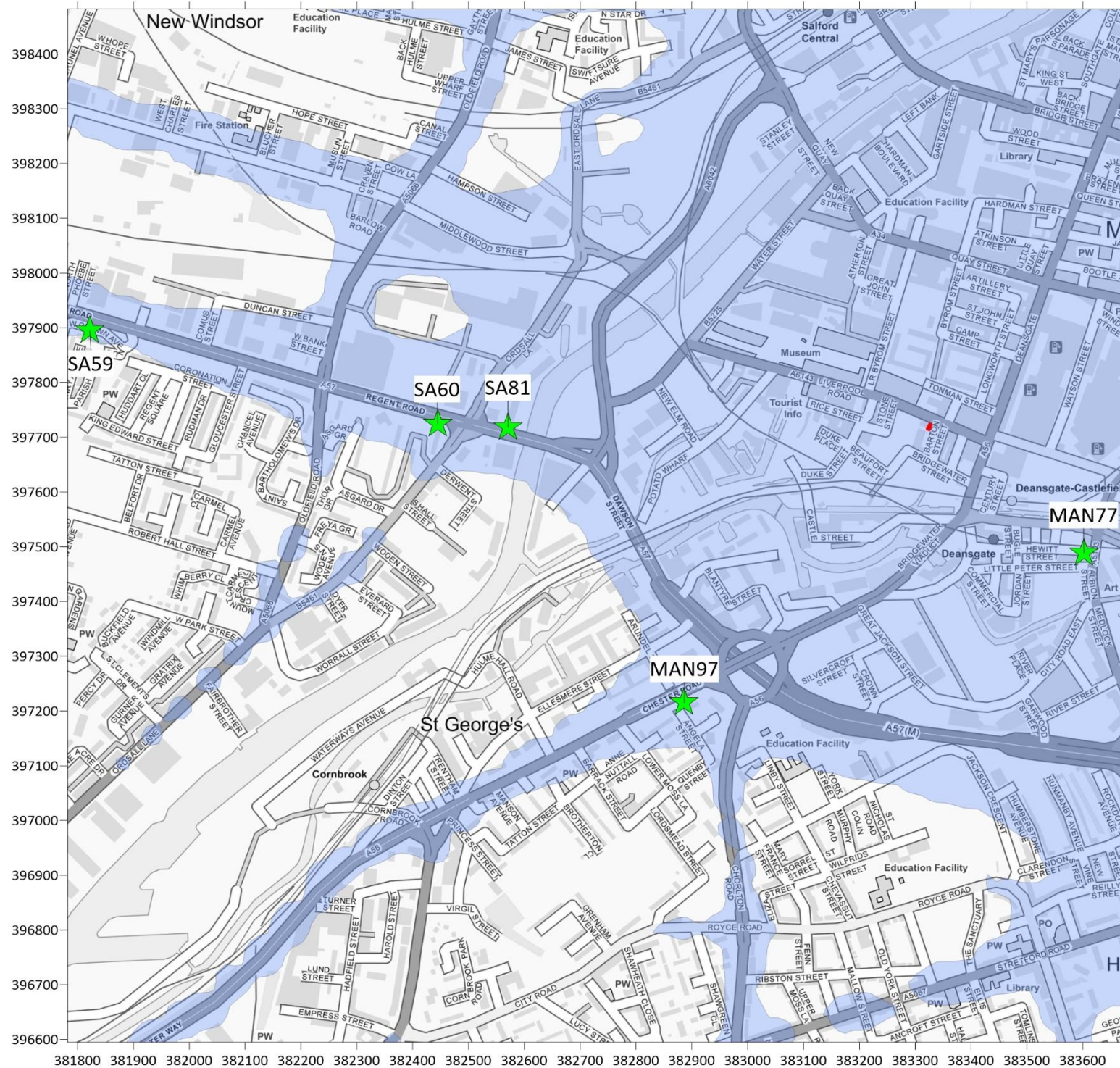
Project Number

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Legend

-  Site Boundary
-  Air Quality Management Area
-  Diffusion Tube Monitoring Locations

Title

Figure 2
Diffusion Tube Monitoring Locations

Project

35 Liverpool Road, Manchester

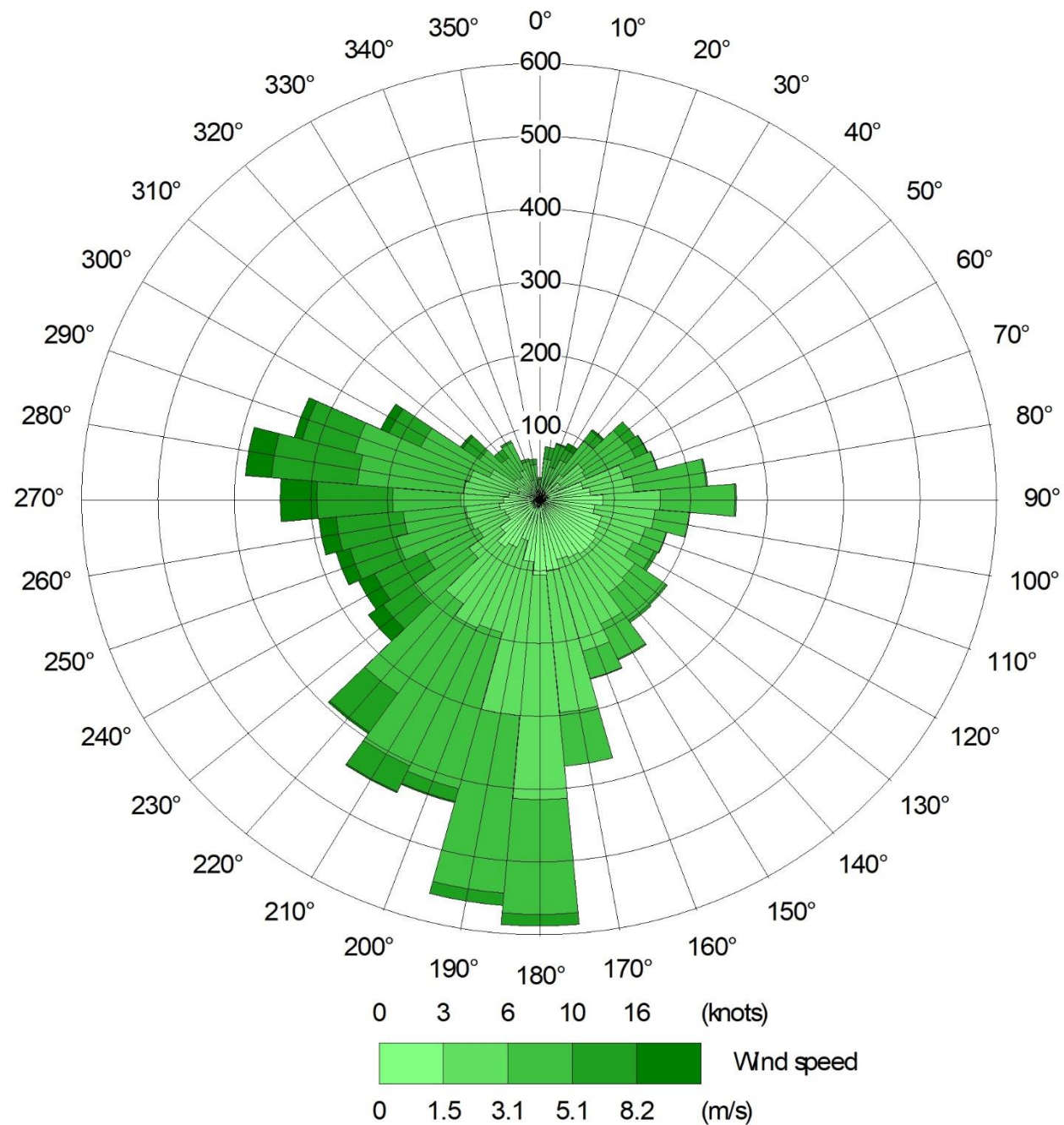
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Title

Figure 3

Wind Rose Manchester Ringway 2019
Meteorological Station

Project

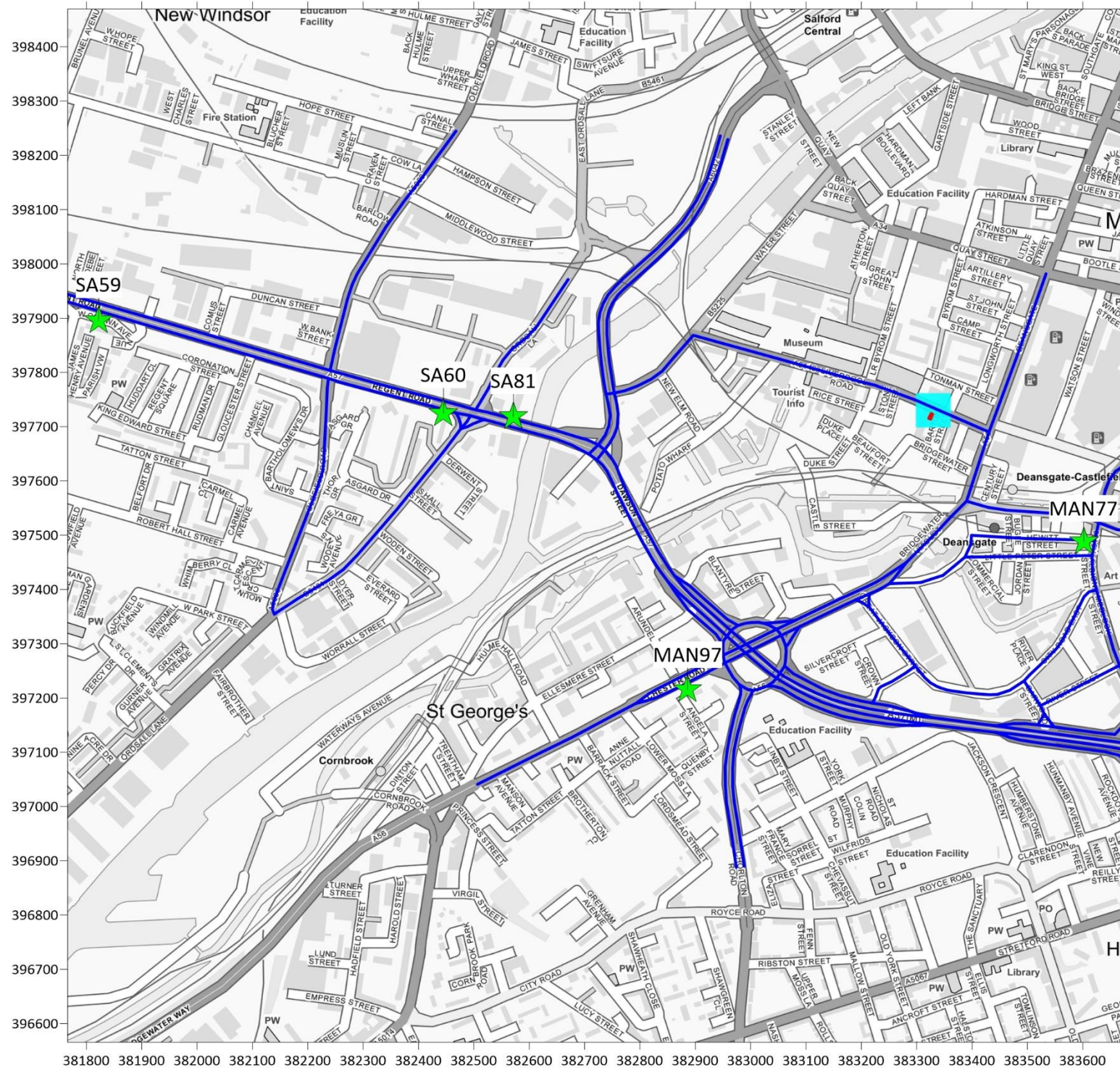
35 Liverpool Road, Manchester

Project Number

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Legend

-  Site Boundary
-  Modelled Road Link
-  Cartesian Grid
-  Diffusion Tube Monitoring

Title

Figure 4
ADMS-Roads Input

Project

35 Liverpool Road, Manchester

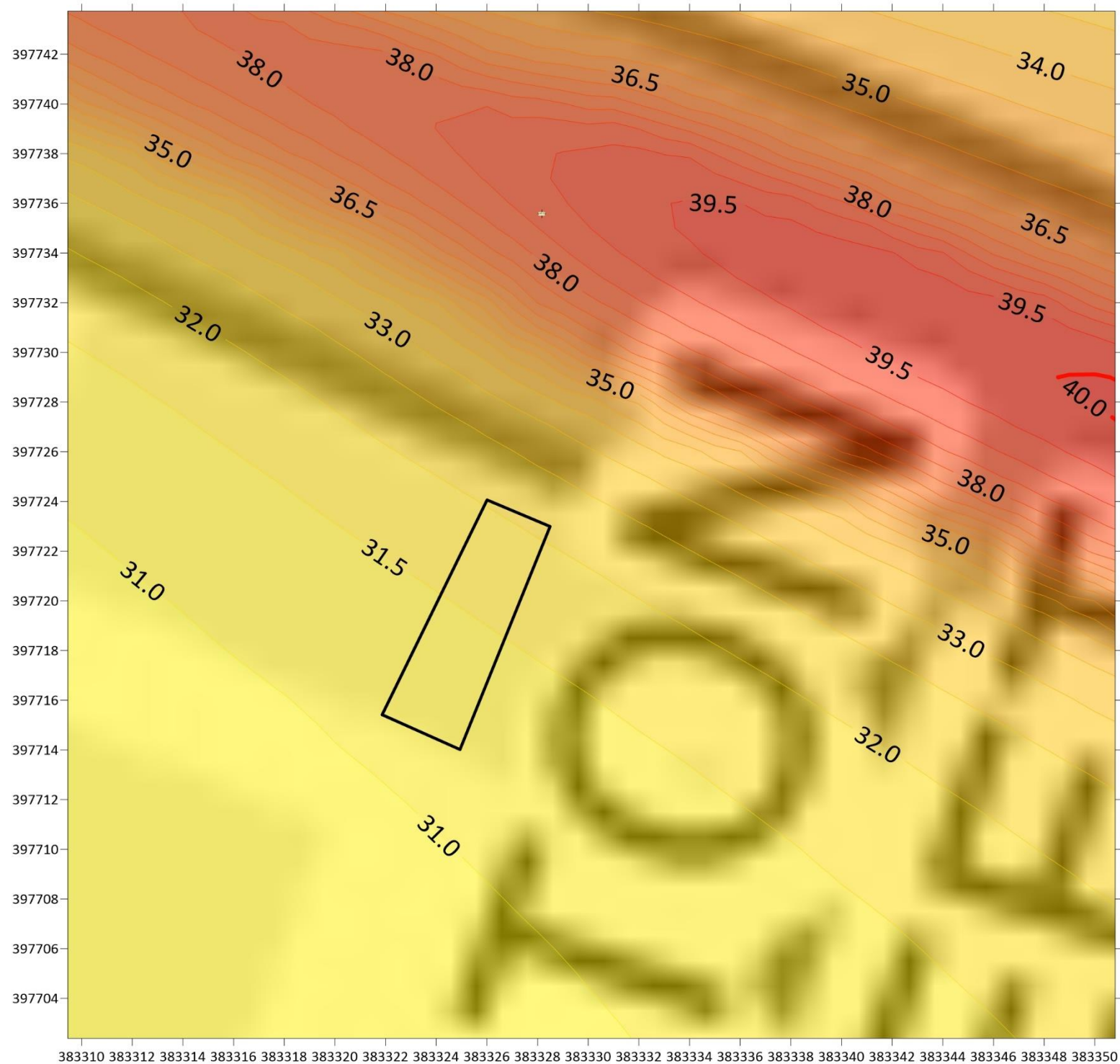
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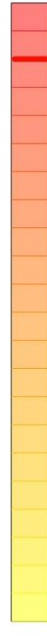
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Legend
 Site Boundary

40.0
39.0
38.0
37.0
36.0
35.0
34.0
33.0
32.0
31.0
30.0
Predicted Annual Mean NO₂ Concentration (µg/m³)

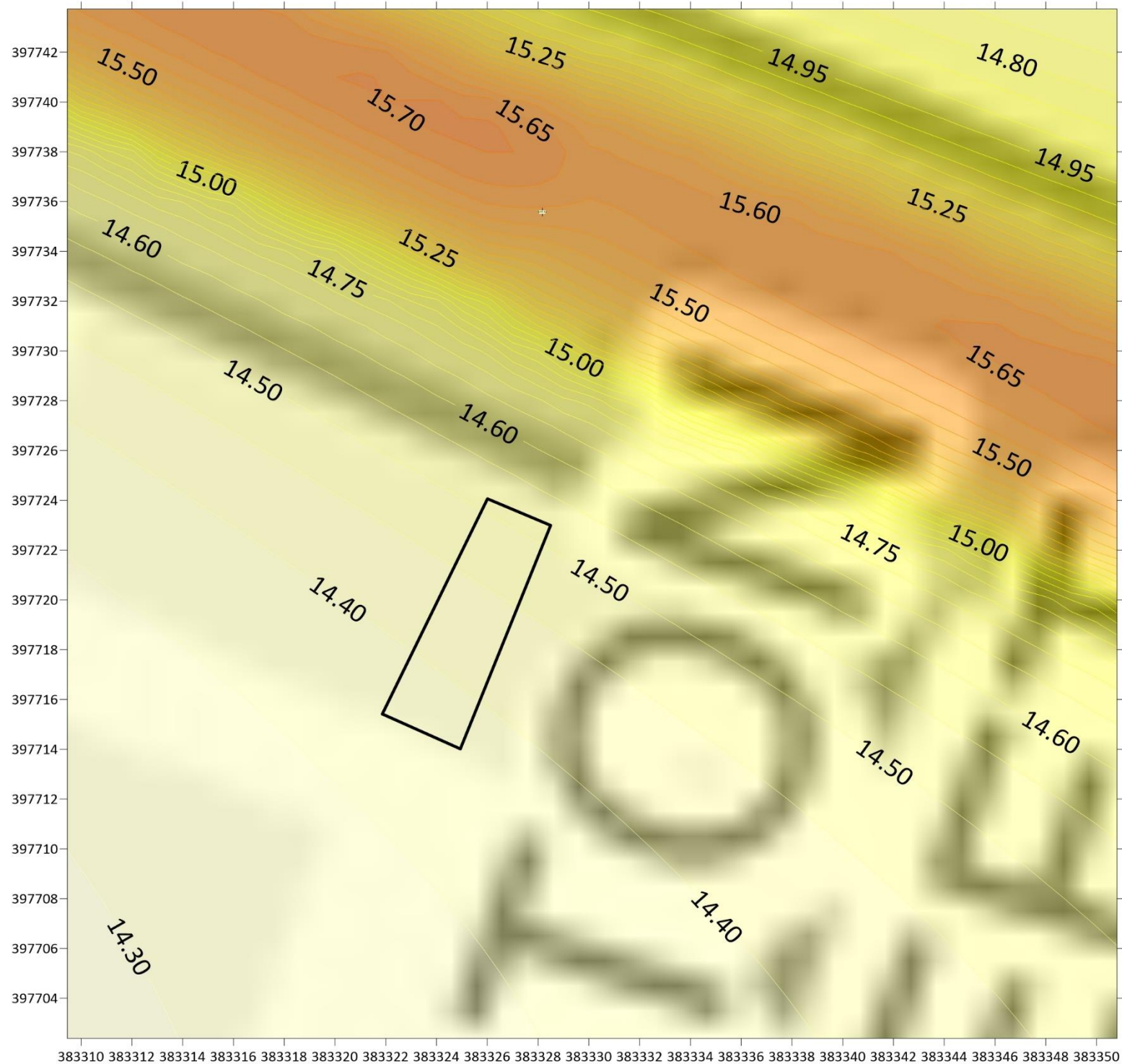
Title
Figure 5
Predicted Annual Mean NO₂ Concentrations (µg/m³) 2023 DS

Project
35 Liverpool Road, Manchester

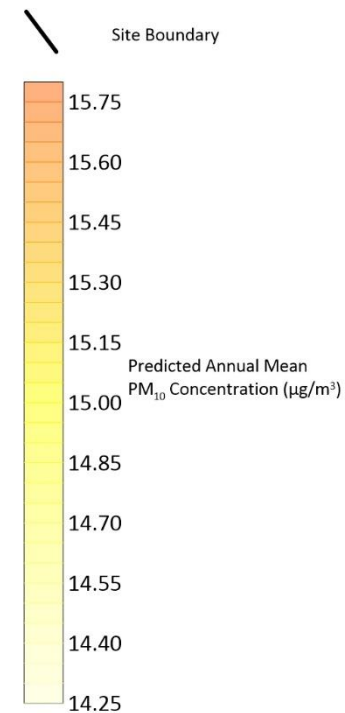
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Legend



Title

Figure 6
Predicted Annual Mean PM₁₀
Concentrations (µg/m³) 2023 DS

Project

35 Liverpool Road, Manchester

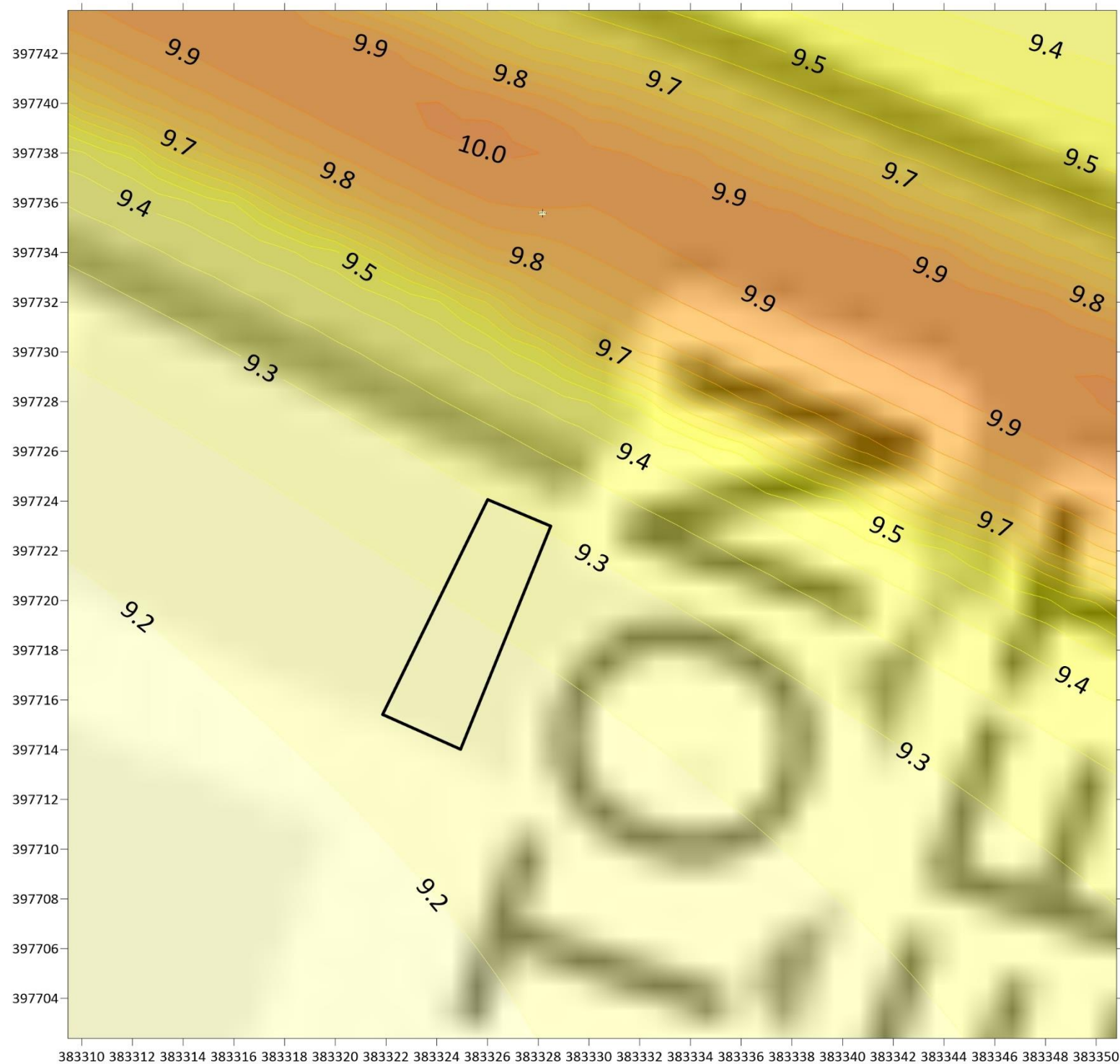
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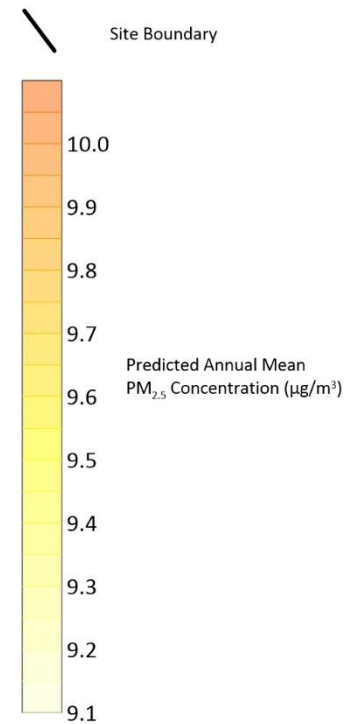
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Legend



Title

Figure 7
Predicted Annual Mean PM_{2.5}
Concentrations (µg/m³) 2023 DS

Project

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APPENDIX B – ASSESSMENT INPUTS

ASSESSMENT INPUTS

The Proposed Development has the potential to introduce future site users to poor air quality. Dispersion modelling using ADMS Roads was therefore undertaken to predict NO₂ and PM₁₀ concentrations across the site to consider site suitability for the proposed end-use.

The assessment was undertaken in accordance with the guidance contained within the DEFRA document LAQM.TG(16)² and the EPUK and IAQM guidance⁴.

Dispersion Model

Dispersion modelling was undertaken using the ADMS-Roads dispersion model (version 5.0). ADMS-Roads is developed by Cambridge Environmental Research Consultants (CERC) and is routinely used throughout the world for the prediction of pollutant dispersion from road sources. Modelling predictions from this software package are accepted within the UK by the Environment Agency and DEFRA.

The model requires input data that details the following parameters:

- Assessment area;
- Traffic flow data;
- Vehicle emission factors;
- Spatial co-ordinates of emissions;
- Street width;
- Meteorological data;
- Roughness length; and
- Monin-Obukhov length.

Assessment Area

Ambient concentrations were predicted over the Proposed Development site and surrounding highway network. One Cartesian grid was included in the model over the area at approximately NGR: 383300, 397700 and 383360, 397760 at height of 1.5m to represent the proposed ground floor level for the 2023 opening year scenario.

Results were subsequently used to produce contour plots within the Surfer software package. Reference should be made to Figure 7 and 9 within Appendix A for a graphical representation of the verification inputs and operation phase DS extents, respectively.

Traffic Flow Data

It is anticipated that the Proposed Development will not generate any AADT flows on the local road network.

Traffic data surrounding the Proposed Development was obtained from the agreed TfGM SATURN model provided by Vectos. This dataset fully accounts for planned growth in line with all committed developments listed in Appendix 2 and is considered to be a robust base upon to assess Proposed Development trips.

Data utilised in the verification process, including Regent Road, Trinity Way, Ordsall Lane and Oldfield Road were obtained from the Department for Transport (DfT).

The DfT Matrix web tool enables the user to view and download traffic flows on every link of the A-road and motorway network in Great Britain for the years 1999 to 2019 and is referenced in the DEFRA guidance LAQM.TG(16)².

It should be noted that the SATURN model and DfT matrix are suitable source of data for air quality assessments and are therefore considered to provide a reasonable representation of traffic flows in the vicinity of the site.

Growth factors provided by the Trip End Model Presentation Program (TEMPRO) software package were utilised to allow for conversion from the obtained 2019 traffic flow to 2023 which was used to represent the opening year scenario. Vehicle speeds were estimated based on the free flow potential of each link and local speed limits. Road widths were estimated from aerial photography and UK highway design standards.

A summary of the traffic data used in the verification scenario is provided in Table B1.

Table B1: 2019 Verification Traffic Data

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L1	A56 (W)	12.5	34,299	3.0	40.0	TC
L2	A56 (W) Slow Down (West)	11.5	17,150	3.0	20.0	TC
L3	A56 (W) Slow Down (East)	9.5	17,150	3.0	10.0	TC
L4	A56 Roundabout	11.3	14,574	3.7	10.0	SATURN
L5	Regent Road (South)	10.5	35,616	3.0	55.0	TC
L6	A57 (E)	7.0	27,986	4.7	55.0	SATURN
L7	Regent Road (North)	10.5	35,616	3.0	55.0	TC
L8	A57 (W)	7.3	24,299	6.9	55.0	SATURN
L9	Regent Road Onslip	6.3	11,622	2.6	32.0	SATURN
L10	Regent Road Offslip	7.5	7,271	2.5	32.0	SATURN
L11	A56 Roundabout	16.0	15,320	4.2	12.0	SATURN
L12	A56 Across Roundabout (East)	7.5	6,057	3.0	32.0	TC
L13	A56 Across Roundabout (West)	7.5	6,057	3.0	32.0	TC
L14	A56 Roundabout	11.0	15,320	4.2	12.0	SATURN
L15	A56 Roundabout	11.0	17,029	3.6	36.0	SATURN
L16	A56 roundabout (Manc Way)	11.0	17,029	3.6	36.0	SATURN
L17	A56 Roundabout	13.0	17,711	2.6	15.0	SATURN
L18	Chorlton Road Slow Down (North)	6.0	6,288	1.0	15.0	TC
L19	Chorlton Road Slow Down (South)	6.2	6,288	1.0	25.0	TC
L20	A56 Roundabout	12.2	14,574	3.7	15.0	SATURN
L21	Chorlton Road (North)	6.0	6,288	1.0	40.0	TC
L22	Chorlton Road (South)	6.3	6,288	1.0	40.0	TC
L23	Manc Way East (up to slip roads)	9.5	38,686	4.0	60.0	TC
L24	Manc Way West (up to slip roads)	9.5	38,686	4.0	60.0	TC
L25	Manc Way Onslip	7.3	9,361	4.6	45.0	SATURN
L26	Manc Way Offslip	7.3	9,992	2.9	50.0	SATURN
L27	Manc Way Offslip Medlock Street	7.5	10,488	2.1	15.0	SATURN
L28	Manc Way Onslip Princess Parkway	7.3	10,488	2.1	32.0	SATURN
L29	Manc Way East (up to University)	8.0	38,686	4.0	55.0	TC

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L30	Manc Way West (up to University)	8.0	38,686	4.0	55.0	TC
L31	Princess Parkway	10.7	25,412	2.0	50.0	TC
L32	Princess Parkway	8.2	25,412	2.0	50.0	TC
L33	Princess Parkway Onslip	7.3	12,706	2.0	25.0	TC
L34	Medlock Street Offslip	7.6	7,825	1.0	25.0	TC
L35	Medlock Street Slow Down	14.5	15,650	1.0	25.0	TC
L36	Medlock Street (River Street to Little Peter Street)	14.6	16,235	1.0	40.0	TC
L37	Albion Street	14.9	16,235	1.0	35.0	TC
L38	Medlock Street Slow Down	14.7	16,235	1.0	15.0	TC
L39	River Street	9.5	1,776	0.0	32.0	TC
L40	City Road East/Great Jackson Street	8.2	5,127	1.9	20.0	SATURN
L41	City Road East/Great Jackson Street (Street Canyon Section)	17.8	5,127	1.9	35.0	SATURN
L42	City Road East/Great Jackson Street	8.2	5,127	1.9	35.0	SATURN
L43	City Road East Slow Down	9.1	3,402	1.1	30.0	SATURN
L44	Great Jackson Street to Bridgewater Viaduct	5.6	1,701	1.1	15.0	SATURN
L45	Bridgewater Viaduct to Great Jackson Street	4.5	1,701	1.1	15.0	SATURN
L46	Garwood Street	8.6	1,272	0.0	32.0	TC
L47	Garwood Street Onslip	5.5	636	0.0	25.0	TC
L48	Garwood Street Offslip	5.5	636	0.0	15.0	TC
L49	Chester Road East (West of Great Jackson Street)	7.3	6,057	3.0	40.0	TC
L50	Chester Road East (West of Great Jackson Street)	7.3	12,113	3.0	40.0	TC
L51	Chester Road East (A56 Roundabout Exit)	3.8	6,057	3.0	20.0	TC
L52	Chester Road East (West of Great Jackson Street)	7.5	6,057	3.0	25.0	TC
L53	Chester Road East (West of Great Jackson Street)	10.8	12,113	3.0	20.0	TC
L54	Chester Road East (A56 Roundabout Approach)	5.6	6,057	3.0	20.0	TC
L55	Chester Road East (Great Jackson Street to Old Deansgate) Eastbound	7.3	11,562	3.0	32.0	TC
L56	Chester Road East (Great Jackson Street to Old Deansgate) Westbound	6.3	11,562	3.0	32.0	TC
L57	A56 Bridgewater Viaduct	10.8	18,371	3.0	32.0	TC
L58	Old Deansgate Slow Down	9.3	1,992	2.4	40.0	SATURN
L59	Old Deansgate	6.5	1,992	2.4	40.0	SATURN
L60	Little Peter Street	6.1	1,611	0.0	15.0	TC
L61	Whitworth Street West - Slow Down	11.5	9,152	1.0	15.0	TC
L62	Whitworth Street West	11.5	9,152	1.0	32.0	TC
L63	Whitworth Street East - Slow Down	10.5	11,797	1.0	15.0	TC

Road Link		Road Width (m)	24 Hour AADT Flow	HDV Pop (%)	Mean Vehicle Speed (km/hr)	Data Source
L64	Whitworth Street East	10.5	11,797	1.0	48.0	TC
L65	Deansgate	12.0	16,939	3.0	32.0	TC
L66	Albion Street	15.6	16,029	3.0	35.0	TC
L67	Hewitt Street	5.0	515	0.0	15.0	TC
L68	Hewitt Street	5.1	515	0.0	30.0	TC
L69	Melborne Street	6.5	131	0.0	32.0	TC
L70	Regent Road (West) Slow	11.1	19,641	4.3	15.0	DfT
L71	Regent Road (West) Slow	7.3	19,641	4.3	20.0	DfT
L72	Regent Road (East) Slow	7.0	19,641	4.3	20.0	DfT
L73	Regent Road (East) Slow	9.8	19,641	4.3	15.0	DfT
L74	Regent Road (West) Slow	7.0	19,641	4.3	32.0	DfT
L75	Regent Road (West) Slow	10.0	19,641	2.1	15.0	DfT
L76	Regent Road (East) Slow	7.2	19,641	2.1	32.0	DfT
L77	Regent Road (East) Slow	7.3	19,641	2.1	15.0	DfT
L78	Regent Road (West) Speed Up	7.1	20,767	2.0	15.0	DfT
L79	Regent Road (West)	7.5	20,767	2.0	32.0	DfT
L80	Regent Road (East) Slow Down	9.5	20,767	2.0	15.0	DfT
L81	Regent Road (East)	7.5	20,767	2.0	35.0	DfT
L82	Liverpool Road Slow Down	10.3	5,372	3.4	15.0	DfT
L83	Water Street/Liverpool Street	8.2	5,372	3.4	32.0	DfT
L84	Water Street Slow Down	15.6	5,372	3.4	15.0	DfT
L85	Trinity Way (North)	8.3	10,803	1.1	40.0	DfT
L86	Trinity Way (South)	8.3	10,803	1.1	40.0	DfT
L87	Oldfield Road (North) Slow Down	13.1	9,755	2.3	15.0	DfT
L88	Oldfield Road (North)	9.9	9,755	2.3	40.0	DfT
L89	Oldfield Road (South) Slow Down	12.4	7,085	2.7	15.0	DfT
L90	Oldfield Road (South)	8.2	7,085	2.7	40.0	DfT
L91	Ordsall Lane (South)	8.7	11,421	1.8	32.0	DfT
L92	Ordsall Lane (South) Slow Down	13.2	11,421	1.8	10.0	DfT
L93	Regent Road onto Ordsall Lane	4.0	3,807	1.8	10.0	DfT
L94	Ordsall Lane onto Regent Road	4.1	3,807	1.8	10.0	DfT
L95	Ordsall Lane/Regent Road Junction	15.0	3,807	1.8	10.0	DfT
L96	Ordsall Lane (North) Slow Down	18.3	9,083	1.8	10.0	DfT
L97	Ordsall Lane (North)	10.3	9,083	1.8	32.0	DfT

Reference should be made to Figure 6 within Appendix A for a graphical representation of the road link locations used within the verification assessment. The road width, canyon height and mean vehicle speed shown in Table B1 remained the same for the 2023 scenarios. A condensed version of the 2023 traffic data is provided in Table B2, it is important to know that the DS model includes factored traffic data for all road links specified in Table B1

A summary of the 2023 traffic data is shown in Table B2.

Table B2: 2023 Traffic Data

Road Link		DS Scenario	
		24 Hr AADT Flow	HDV Prop (%)
L57	A56 Bridgewater Viaduct	19,001	3.0
L62	Whitworth Street West	9,466	1.0
L65	Deansgate	17,520	3.0
L82	Liverpool Road Slow Down	5,556	3.4
L83	Water Street/Liverpool Street	5,556	3.4

Reference should be made to Figure 6 within Appendix A for a graphical representation of the road link locations used within the operation phase assessment.

Emission Factors

Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 10.1) released in August 2020, which incorporates updated COPERT 5.3 vehicle emissions factors for NO_x and PM and EURO 6 vehicle fleet sub-categories.

There is current uncertainty over NO₂ concentrations within the UK, with roadside levels not reducing as previously expected due to the implementation of new vehicle emission standards. Therefore, 2019 emission factors have been utilised for the prediction of pollution levels for all scenarios in preference to the development opening year in order to provide a robust assessment.

NO_x to NO₂ Conversion

Predicted annual mean NO_x concentrations from the dispersion model were converted to NO₂ concentrations using the NO_x to NO₂ Calculator (v.8.1) provided by DEFRA, which is the method detailed within LAQM.TG(16)².

Meteorological Data

Meteorological data used in this assessment was taken from Manchester Ringway meteorological station over the period 1st January 2019 to 31st December 2019 (inclusive).

Manchester Ringway meteorological station is located at approximate NGR: 381745, 383960 which is approximately 14km south of the Proposed Development.

All meteorological records used in the assessment were provided by Atmospheric Dispersion Modelling (ADM) Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 3 within Appendix A for a wind rose of utilised meteorological data.

Roughness Length

The specific roughness length (z₀) values used to represent conditions during the verification process, DS scenario, as well as conditions at the Manchester Ringway meteorological station are summarised in Table B3.

Table B3: Utilised Roughness Lengths

Scenario	Roughness Length (m)	ADMS Description
Verification and DS Scenario	1.0	Cities and Woodlands
Manchester Ringway meteorological station	0.3	Agricultural Areas (Max)

These values of z_0 are considered appropriate for the morphology of the assessment area.

Monin-Obukhov Length

The Monin-Obukhov length provides a measure of the stability of the atmosphere within certain urban or rural contexts. The specific length values used to represent conditions during the verification process, DS scenario, as well as conditions at the Manchester Ringway meteorological station are summarised in Table B4

Table B4: Utilised Monin-Obukhov Lengths

Scenario	Monin-Obukhov Length (m)	ADMS Description
Verification and DS Scenario	30	Cities and large towns
Manchester Ringway meteorological station	30	Mixed urban/industrial

This Monin-Obukhov value is considered appropriate for the morphology of the assessment area.

Background Concentrations

The annual mean NO₂ concentrations detailed in Table 4, was used in the dispersion modelling assessment to represent annual mean pollutant levels at the Proposed Development site and local monitoring sites.

Table B5 displays the specific background concentrations as predicted by DEFRA, utilised to represent the condition at the monitoring locations used within the verification process.

Table B5: Predicted Background Pollutant Concentrations for Diffusion Tubes

Monitoring Location	DEFRA Grid Square	Pollutant	2019 Predicted Background Concentration (µg/m ³)
MAN 77	383500, 397500	NO _x	39.95
		NO ₂	26.07
MAN 97, SA60, SA81	382500, 397500	NO _x	33.65
		NO ₂	22.79
SA59	381500, 397500	NO _x	30.19
		NO ₂	20.80

Similar to emission factors, background concentrations for 2019 were utilised in preference to predicted background concentrations for the development opening year (2023). This provided a robust assessment and is likely to overestimate actual pollutant concentrations during the operation of the proposals.

Verification

The predicted results from a dispersion model may differ from measured concentrations for a large number of reasons, including:

- Estimates of background concentrations;
- Uncertainties in source activity data such as traffic flows and emission factors;
- Variations in meteorological conditions;
- Overall model limitations; and
- Uncertainties associated with monitoring data, including locations.

Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects.

For the purpose of this assessment model verification was undertaken for 2019, using traffic data, meteorological data and monitoring results from this year.

MCC and SCC undertakes periodic monitoring of NO₂ concentrations at 5 roadside monitoring location within the assessment extents. The road contribution to total NO_x concentration was calculated from the monitored NO₂ result for use in the verification process. This was undertaken following the methodology contained within DEFRA guidance LAQM.TG(16)². The monitored annual mean NO₂ concentration and calculated road NO_x concentration are summarised in Table B6.

Table B6: Monitoring Results

Site ID	Monitored Road NO _x Concentration (µg/m ³)	Modelled Road NO _x Concentration (µg/m ³)	% Difference ((Monitored Modelled)/Monitored) * 100
MAN77	10.80	44.21	76%
MAN97	14.38	25.01	43%
SA81	39.52	56.61	30%
SA60	25.01	34.35	27%
SA59	9.23	26.63	65%

The monitored and modelled NO_x road contribution concentrations were graphed and the equation of the trend line based on the linear progression through zero was calculated, as shown in Graph 1. This indicated that a verification factor of **1.6099** was required to be applied to all NO_x modelling results, showing the model overestimated pollutant concentrations throughout the assessment extents. Graph 1 is provided below.

Graph 1 - Verification Adjustment Factor

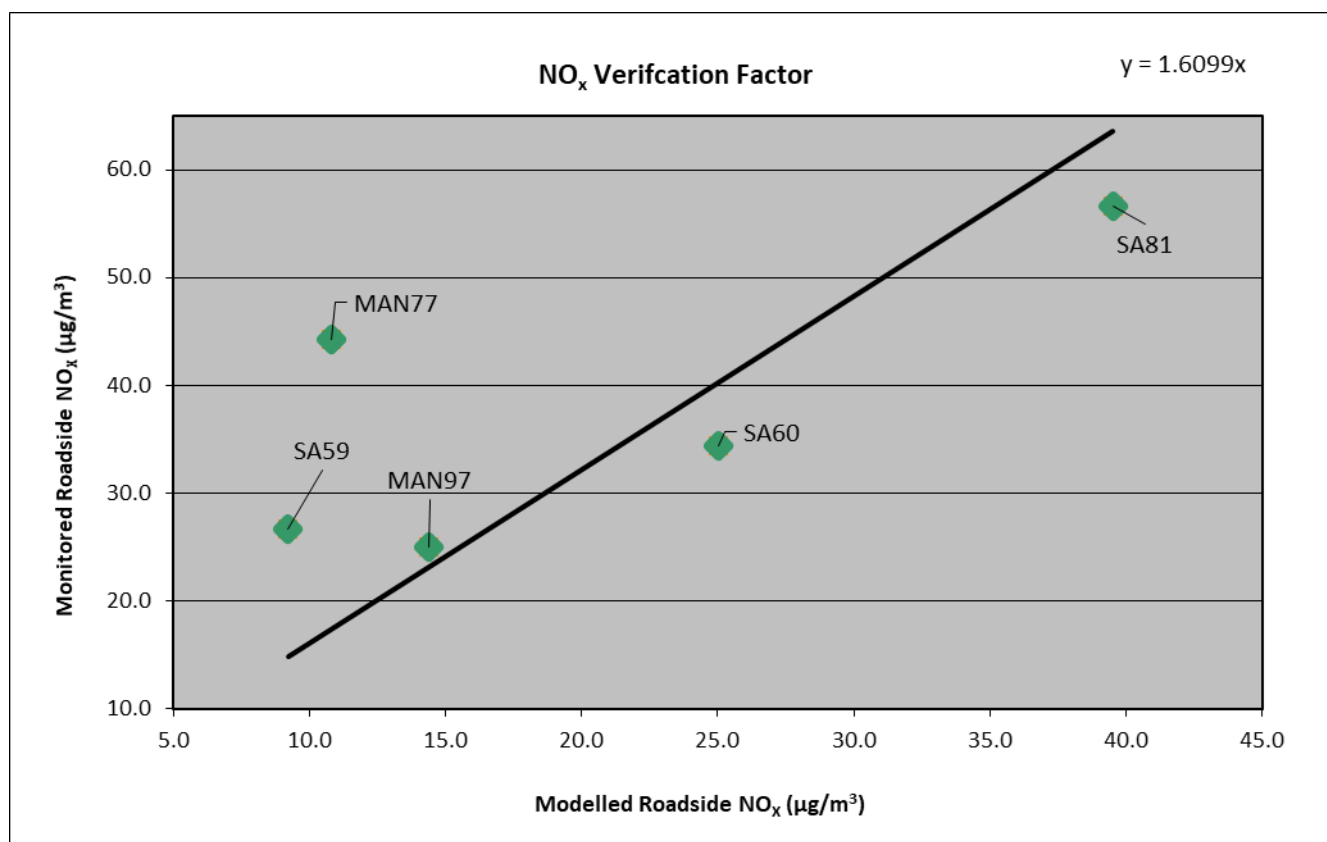


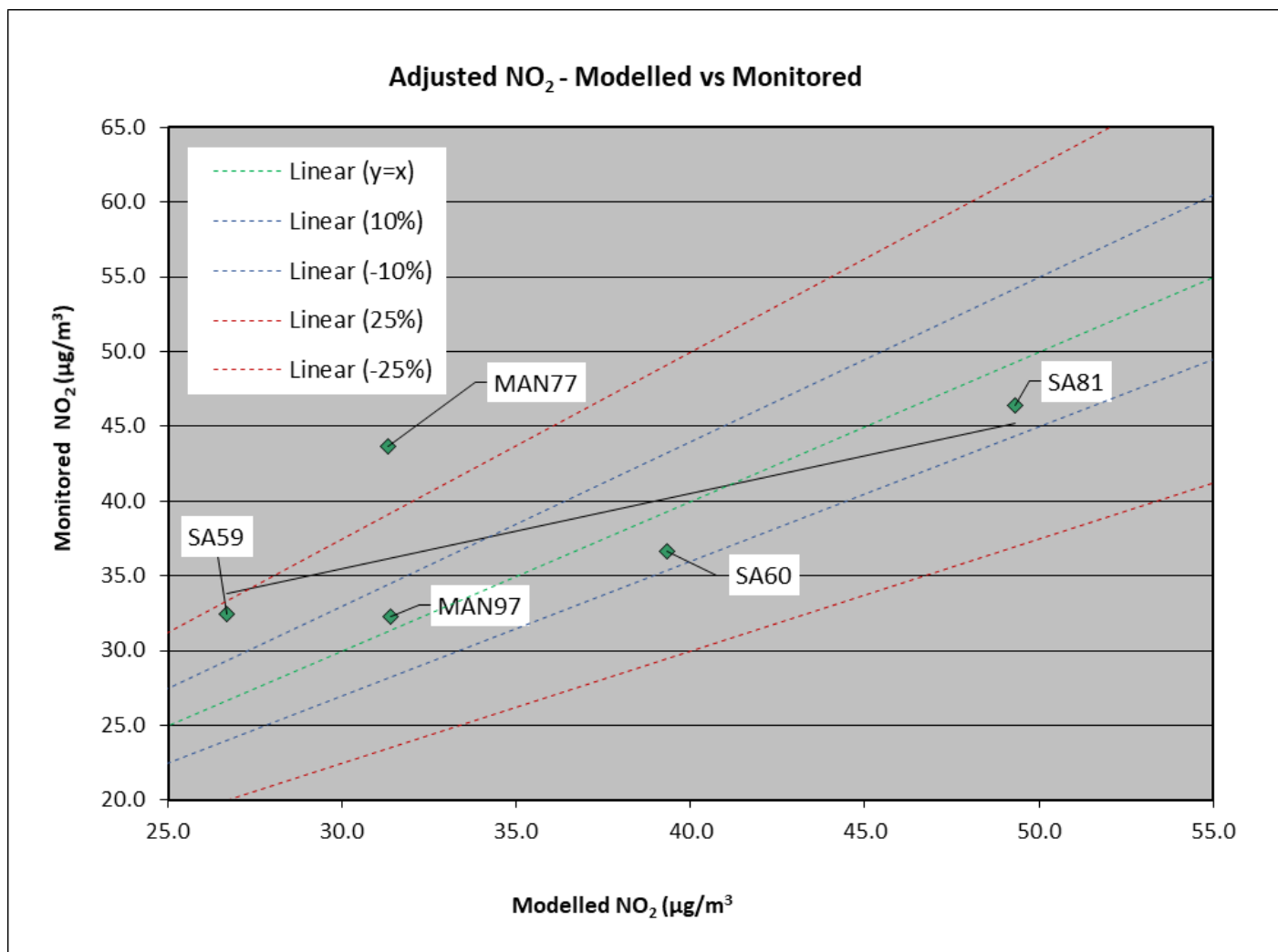
Table B7 presents the monitored annual mean NO₂ concentrations and the adjusted modelled total NO₂ concentration based on the above verification factor. Exceedances of the annual mean NO₂ AQO are highlighted in **bold**.

Table B7: Modelled Concentrations

Site ID	Monitored Road NO ₂ Concentration (µg/m³)	Adjusted Modelled Road NO ₂ Concentration (µg/m³)	% Difference ((Monitored Modelled)/Monitored) * 100
MAN77	43.66	31.33	28%
MAN97	32.29	31.39	3%
SA81	46.41	49.30	-6%
SA60	36.66	39.33	-7%
SA59	32.45	26.70	18%

As demonstrated in Table B7, the percentage difference between modelled and monitored concentrations is deemed acceptable and is less than 25% in at four locations (MAN97, SA81, SA60 and SA59) cases, and less than 30% at the MAN77 location. This reduces uncertainties in the model predictions and provide a robust representation of pollutant concentrations in accordance with the guidance suggested in LAQM.TG(16)².

A graphical representation of the adjusted NO₂ concentrations is provided within Graph 2.



As PM monitoring is not undertaken within the assessment extents, the NO_x adjustment factor of **1.6099** was utilised to adjust model predictions of PM in accordance with the guidance provided within LAQM.TG(16)².

APPENDIX C – ASSESSORS CURRICULUM VITAE

JOSHUA DAVIES

Principal Air Quality Consultant

BSc (Hons) AMIEnvSci

KEY EXPERIENCE

Josh is an Environmental Consultant with specialist experience in the air quality sector. His key capabilities include:

- Production of Air Quality Assessments to the Department for Environment, Food and Rural Affairs (DEFRA), Environment Agency and Environmental Protection UK (EPUK) methodologies for clients from the residential, retail and commercial sectors.
- Detailed dispersion modelling of road vehicle emissions using ADMS-Roads. Studies have included impact assessment of pollutant concentrations at various floor levels and assessment of suitability of development sites for proposed end-use.
- Assessment of dust impacts from construction sites to the Institute of Air Quality Management (IAQM) methodology.
- Assessment of Odour Impact from commercial and industrial processes in line with Environment Agency (EA) and IAQM methodologies and guidance
- Quantification of Ecological Impacts associated with Nitrogen and Acid Deposition from industrial processes
- Production of air quality mitigation strategies for developments throughout the UK.
- Management of Environmental Permit Applications primarily for the Medium Combustion Plant Directive (MCDP)

SELECT PROJECTS SUMMARY

- Imperial War Museum, Duxford – Air Quality screening assessment associated with dust and odour as a result of proposed restoration activities
- London South Bank University -AQA for redevelopment of the campus, with associated energy centre
- Scunthorpe United Football Stadium - AQA for new sports stadium and commercial and retail park
- Heineken UK, Manchester – Production of various AQAs for the expansion of the Manchester Brewery site.
- Cricklewood Freight Terminal – AQA for an aggregate freight terminal in Brent. Dust and HGV impact assessment and mitigation strategy
- Llay Wrexham – AQ associated with a Short-Term Reserve Operation site in line with the Medium Combustion Plant Directive (MCPD)

ES Chapters

- Great Jackson Street Framework - Production of a number of ES chapters for large-scale mixed use multi storey buildings
- Keele University – Road and Energy Assessment for the proposed re-development of the student campus
- Newton Farm, Perth - EIA for a medium scale residential development in close vicinity to the A9.

Odour Assessments

- Clipsone House Farm – Quantitative odour and ammonia assessment in support of a proposed extension to a large-scale poultry farm.
- Chatteris AD Plant - Quantitative odour modelling and sniff tests to discharge condition on an existing anaerobic digestion plant
- Jennychem, Snodland - Risk Assessment and Best Practice Statement in support of the proposed car repairs facility spray booth

London Borough of Southwark Experience

- Camberwell Road, Southwark - Exposure assessment for a proposed gym within an AQMA, 24 hour and 1 hour mean AQOs assessed.
- Pelier Street- AQA for a residential development located within the Southwark AQMA
- Haddonfield Estate - AQA for a residential development located within the Southwark AQMA
- Lavington Street - AQA for mixed use scheme in AQMA in Southwark, including an AQN assessment.
- Daniels Road - AQA for a residential development within the Southwark AQMA

Educational Developments

- Brinsworth Comprehensive School, Rotherham - Baseline and Construction phase assessment for the proposed extension and new Sports Hall. Site suitability due to the Schools close proximity to the M1 Motorway.
- Ashton House, Waterloo Street, Bolton – Exposure and impact assessment related to a proposed expansion of the existing site located within the Greater Manchester AQMA
- St Marys and Johns CE School, Barnet AQA for the refurbishment of the existing school and the construction of a 3-storey classroom block, within the borough wide Barnet AQMA.
- St Peters Catholic School, Guildford - AQA for the redevelopment of the existing site, and the construction of a two-storey classroom block

Monitoring & Surveying Experience

- Co-ordination and management of NO2 diffusion tube monitoring surveys in accordance with DEFRA guidance.
- Odour Acuity certified, undertaken numerous site sniff tests

QUALIFICATIONS

- Bachelor of Science
- Member of the Institute of Environmental Science (IES)
- Odour Acuity Certified